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Direct Numerical Simulations of the Three Dimensional Dynamics of Surfactant Laden Retracting Ligaments[1] RICARDO CONSTANTE-AMORES, ASSEN BATCHVAROV, LYES KAHOUADJI, Imperial College London, SEUNGWON SHIN, Hongik University, South Korea, JALEL CHERGUI, DAMIR JURIC, LIMSI, CNRS, France, RICHARD CRASTER, OMAR MATAR, Imperial College London — We present three-dimensional direct numerical simulations for the retraction of surfactant-laden Newtonian ligaments. In the absence of surfactant, the dynamics is described non-dimensionally by the ligament aspect ratio and the Ohnesorge number, which relates the viscous forces to surface tension forces. The addition of surfactant leads to surface tension gradients resulting in Marangoni stresses on the interface. We consider surfactants, which are either insoluble, where molecules remain only on the interface, or soluble which allows surfactant mass transfer between the bulk and the interface via adsorption and desorption mechanisms. In addition to the ligament aspect ratio and Ohnesorge number, we take into account variation of the Peclet, Biot, and elasticity numbers to elucidate the physical mechanisms which control the dynamics of the ligament in the presence of surfactant. An analysis of the effect of surfactant concentration, surface tension, tangential velocity, and Marangoni stresses is provided and of their role in partial/complete ligament breakup suppression.

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